Exhibit R-2, PB 2010 Office of Secretary Of Defense RDT&E Budget Item Justification		DATE: May 2009
APPROPRIATION/BUDGET ACTIVITY 0400 - Research, Development, Test & Evaluation, Defense-Wide/BA 3 - Advanced Technology Development (ATD)	**R-1 ITEM NOMENCLATURE** PE 0603755D8Z High Performance Computing Modernization Program	

COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
Total Program Element	198.234	220.345	221.286						Continuing	Continuing
P507: High Performance Computing Modernization Program	198.234	220.345	221.286						Continuing	Continuing

Note

Other Program Funding Comment:

PE #090219D8Z Major Equipment OSD

In FY 2008 two centers were upgraded and funding exists in the FY 2009 Procurement budget to upgrade 2 centers and provide for initial mass storage investments.

The following dedicated high performance computing project investments were also provided upgrades with FY2008 procurement funding through an annual competitive process: Army Research Laboratory, Aberdeen, MD and the Air Force Research Laboratory, Rome, NY. Funding exists in the FY2009 procurement budget to provide for approximately four DHPCPIs.

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program (HPCMP) supports warfighter needs for technological superiority and military dominance on the battlefield by providing advanced computational services to U.S. weapons system scientists and engineers. Exploiting continuous HPC technology advances, the DoD research, development, test and evaluation (RDT&E) community is able to resolve critical scientific and engineering problems more quickly and with more precision. This feeds directly into the acquisition process by improving weapons system designs through an increased fundamental understanding of materials, aerodynamics, chemistry, fuels, acoustics, signal image recognition, electromagnetics, and other areas of basic and applied research as well as enabling advanced test and evaluation (T&E) environments that allow synthetic scene generation, automatic control systems and virtual test environments. HPC has been identified as a key enabling technology essential to achieving the DoD's science and technology (S&T) and T&E objectives. To emphasize the common missions and responsibilities of DoD high performance computing centers, the DoD undertook administrative actions to designate Major Shared Resources Centers (Air Force Research Laboratory, Army Research Laboratory, Engineering Research and Development Center, and Naval Oceanographic Office) together with the Maui High Performance Computing Center and the Arctic Region Supercomputing Center collectively as DoD Supercomputing Resource Centers (DSRCs). Two other congressionally established centers that provide supercomputing services to the DoD do not receive HPCMP support; the Army High Performance Computing Research Center, Minneapolis, MN and the Space and Missile Defense Command, Huntsville, AL receive Army operational support. The AHPCRC was retired

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in FY2008. Additionally, funding for specialized programs is provided through dedicated HPC project investments (DHPCPIs). DHPCPIs support a one-time need and have no legacy within the HPCMP. DSRCs and DHPCPIs directly support the DoD S&T and T&E laboratories and test centers and are accessible to local and remote scientists and engineers via high-speed network access. In FY2009 and continuing into FY2010, significant investments will be made in mass data storage systems to replace systems reaching the end of their useful life. An integral part of the program is providing for the adaptation of broadband, widely used applications and algorithms to address S&T and T&E requirements, along with continued training of users in new system designs and concepts. The HPCMP pursues continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate sharing of knowledge, tools, and expertise. HPCMP users average 5,000 scientists and engineers at approximately 180 locations (DoD laboratories, test centers, academic institutions and commercial businesses). The integrated HPCMP consists of DSRCs; the Defense Research and Engineering Network (DREN); and Software Application Support. DSRCs are responsible for as large a part of DoD`s S&T and T&E computational workload as feasible. DSRCs provide extensive capabilities to address user requirements for hardware, software, and programming environments. DHPCPIs augment the SRCs to form total HPCMP computational capability. DHPCPIs address critical HPC requirements that cannot be met at DSRCs, such as real-time, and near real-time computing requirements, and leverage significant HPC and mission expertise located at these remote sites. All elements of the HPCMP are interconnected with all S&T and T&E user sites via the DREN. The Software Application Support component develops critical common DoD applications programs that run efficiently on advanced HPC systems, supports technology transition activities with academic and commercial institutions, trains users, builds collaborative programming environments, and develops mechanisms to protect high value HPC application codes. The Computational Research and Engineering Acquisition Tools and Environments (CREATE) will produce supercomputer-based engineering design and test tools, improving the acquisition process for major weapons systems across the DoD. Modernization of DoD HPC capability and fulfillment of the program's vision and goals requires an on-going strategy that addresses all HPC aspects. While advancing the level of hardware performance is critical to success, the higher objective is enabling better scientific research, test and evaluation environments, and technology development for superior weapons, warfighting, and related support systems. Program goals are to acquire, deploy, operate and maintain best-value supercomputers; acquire, develop, deploy and support software applications and computational work environments that enable critical DoD research, development and test challenges to be analyzed and solved; acquire, deploy, operate and maintain a communications network that enables effective access to supercomputers and to distributed S&T/T&E computing environments; continuously educate the RDT&E workforce with the knowledge needed to employ computational modeling effectively and efficiently; and promote collaborative relationships among the DoD computational science community, the national computational science community and minority serving institutes.

As result of prior year funding reductions, HPCMP adjustments continued into FY2008. Reduced vendor response times and reliability metrics continued on maintenance contracts for selected large HPC systems leading to longer system downtime events and less system downtime accountability from maintenance service providers. Staff reductions lead to the loss of some qualified technical personnel; however, the award of a consolidated center support contract in FY2008 mitigated these losses. This action plus the earlier consolidation of help desk and scientific visualization functions worked to keep the adjustments relatively invisible to the customer from a service perspective. Existing contracts supporting the PET effort are being re-competed with a new award (s) made in FY2009.

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B. Program Change Summary ($ in Millions)

	FY 2008	**FY 2009**	**FY 2010**	**FY 2011**
Previous President's Budget	205.017	208.079	215.278	
Current BES/President's Budget	198.234	220.345	221.286	
Total Adjustments	-6.783	12.266	6.008	
Congressional Program Reductions				
Congressional Rescissions		-1.214		
Total Congressional Increases		13.480		
Total Reprogrammings	-2.297			
SBIR/STTR Transfer	-4.076			
Balance attributed to undistributed reductions levied by legislation	-0.410	0.000	0.000	
Program Budget Decision	0.000	0.000	8.923	
Other			-2.915	

Congressional Increase Details ($ in Millions)

	FY 2008	**FY 2009**
Project: P507, **Congressional Adjustments** Funding increases were provided for a NRL Supercomputing Information Prototype, Artic Regional Supercomputer, High Performance Computational Design of Novel Materials, and MHPCC.	0.000	13.480

Change Summary Explanation

A program budget decision provided additional funding to support full operations and maintenance at the Maui High Performance Computing Center and the Arctic Region Supercomputing Center.

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PE 0603755D8Z High Performance Computing Modernization Program | | | | | | PROJECT NUMBER
P507 | |

COST ($ in Millions)	FY 2008 Actual	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
P507: High Performance Computing Modernization Program	198.234	220.345	221.286						Continuing	Continuing

Note

Other Program Funding Comment:

PE #090219D8Z Major Equipment OSD

In FY 2008 two centers were upgraded and funding exists in the FY 2009 Procurement budget to upgrade two centers and provide for initial mass storage investments.

The following dedicated high performance computing investments (DHPCIs) were also provided upgrades with FY2008 procurement funding through an annual competitive process: Army Research Laboratory, Aberdeen, MD and the Air Force Research Laboratory, Rome, NY. Funding exists in the FY2009 procurement budget to provide for approximately four DHPCPIs.

A. Mission Description and Budget Item Justification

The Department of Defense (DoD) High Performance Computing (HPC) Modernization Program supports the needs of the warfighter for technological superiority and military dominance on the battlefield by providing advanced computational services to U.S. weapons system scientists and engineers. By exploiting continuous advances in HPC technology, the defense research, development, test and evaluation (RDT&E) community is able to resolve critical scientific and engineering problems more quickly and with more precision. The results of these efforts feed directly into the acquisition process by improving weapons system designs through an increased fundamental understanding of materials, aerodynamics, chemistry, fuels, acoustics, signal image recognition, electromagnetics, and other areas of basic and applied research as well as enabling advanced test and evaluation environments that allow synthetic scene generation, automatic control systems and virtual test environments. As such, HPC has been identified as a key enabling technology essential to achieving the objectives of the DoD's science and technology (S&T) and test and evaluation (T&E) programs.

The program supports six DoD Supercomputing Resource Centers (DSRCs). Two other centers, established by congress do not receive programmed support through HPC Modernization Program funding, but provide supercomputing services to the DoD. The Army High Performance Computing Research Center (AHPCRC), Minneapolis, MN and the Space and Missile Defense Command, Huntsville, AL, receive their support for operations through the Army. The AHPCRC was retired in FY2008. Additionally, funding for specialized programs is provided through dedicated HPC project investments (DHPCPIs). DHPCPIs support a one-time need and have no legacy within the HPC Modernization Program Centers and DHPCPIs directly support the DoD S&T and T&E laboratories and test centers and are accessible

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to local and remote scientists and engineers via high-speed network access. An integral part of the program is providing for the adaptation of broadband, widely used applications and algorithms to address S&T and T&E requirements, along with continued training of users as new system designs and concepts evolve. The program pursues continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate the sharing of knowledge, tools, and expertise.

HPCMP users average 5,000 scientists and engineers at approximately 180 locations (DoD Laboratories and Test Centers, academic institutions and commercial businesses). The integrated HPC program consists of DSRCs; the DREN; and Software Application Support. DSRCs are responsible for as large a fraction of DoD`s S&T and T&E computational workload as feasible. DSRCs provide extensive capabilities to address user requirements for hardware, software, and programming environments. DHPCPIs augment the DSRCs to form the total HPC Modernization Program computational capability. DHPCPIs address critical HPC requirements that cannot be met at DSRCs, such as real-time, and near real-time computing requirements, and leverage significant HPC and mission expertise located at these remote sites. All elements of the HPC Modernization Program are interconnected with all S&T and T&E user sites via the DREN. Additionally, the Software Application Support component develops critical common DoD applications programs that run efficiently on advanced HPC systems, supports technology transition activities with academic and commercial institutions, trains users, builds collaborative programming environments, and develops mechanisms to protect high value HPC application codes.

True modernization of DoD`s HPC capability and fulfillment of the program's vision and goals requires an on-going program strategy that addresses all aspects of HPC. While advancing the level of hardware performance is critical to success, the higher objective is to enable better scientific research, test and evaluation environments, and technology development for superior weapons, warfighting, and related support systems. The Program goals are to (1) Acquire, deploy, operate and maintain best-value supercomputers; (2) Acquire, develop, deploy and support software applications and computational work environments that enable critical DoD research, development and test challenges to be analyzed and solved; (3) Acquire, deploy, operate and maintain a communications network that enables effective access to supercomputers and to distributed S&T/T&E computing environments; (4) Continuously educate the RDT&E workforce with the knowledge needed to employ computational modeling effectively and efficiently; and (5) Promote collaborative relationships among the DoD computational science community, the national computational science community and minority serving institutes.

The DREN provides wide area network (WAN) connectivity among the Department's S&T and T&E communities. The DREN is implemented through an Intersite Services Contract awarded to MCI (WORLDCOM) during FY 2002. DREN currently provides services to sites throughout the continental United States, Alaska, Hawaii, and can be extended overseas where necessary. Minimal access is DS-3 (45 Mbps) with potential high-end access of OC-768 (40 Gbps) over the next 7 years. Current site connectivity ranges from DS-3 to OC-48 (2 Gbps). A Secret DREN using common Secret systems high key with NSA certified Type-1 encryptors that can transport classified traffic at OC-3 (155 Mbps) has also been deployed. The HPC Modernization Program employs state-of-the-art WAN security and strong host and user security creating a defense-in-depth security architecture.

B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
Department of Defense Supercomputing Resource Centers	107.264	108.423	109.191	

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B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
The program supports six DoD Supercomputing Resource Centers that are responsible for as large a fraction of DoD`s S&T and T&E computational workload as feasible. Dedicated HPC project investments (DHPCPIs) support a one-time need and have no legacy within the HPC Modernization Program. *FY 2008 Accomplishments:* To emphasize the common missions and responsibilities of DoD high performance computing centers, the DoD undertook administrative actions to designate the Major Shared Resources Centers (Air Force Research Laboratory, Army Research Laboratory, Engineering Research and Development Center, and Naval Oceanographic Office) together with the Maui High Performance Computing Center and the Arctic Region Supercomputing Center collectively as DoD Supercomputing Resource Centers (DSRCs). Also during FY2008, the program made other specialized systems investments that were sustained and supported by sponsoring Service organizations. As result of prior year funding reductions, HPCMP adjustments at DSRCs continued into FY2008. Reduced vendor response times and reliability metrics continued on maintenance contracts for selected large HPC systems leading to longer system downtime events and less system downtime accountability from maintenance service providers. Staff reductions lead to the loss of some qualified technical personnel; however, the award of a consolidated center support contract in FY2008 mitigated these losses. This action plus the earlier consolidation of help desk and scientific visualization functions worked to keep the adjustments relatively invisible to the customer from a service perspective. *FY 2009 Plans:* Since 1994, the program has sustained and regularly modernized HPC systems, storage, and scientific data analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements. Six DSRCs will be fully supported in FY2009. Another smaller center sustained and supported by the Army could continue to receive modernization funding through congressional adjustments to the program's annual budget request. Also, beginning in FY2009, the program will make significant investments in mass data storage systems to replace systems that will reach the end of their life cycle. These efforts are planned to continue into future years with no set completion date.				

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B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
FY 2010 Plans: Since 1994, the program has sustained and regularly modernized HPC systems, storage, and scientific data analysis and visualization capabilities to fulfill a significant portion of the science and technology (S&T) and test and evaluation (T&E) community HPC requirements. Six DSRCs will be fully supported in FY2010. Another smaller center sustained and supported by the Army could continue to receive modernization funding through congressional adjustments to the program's annual budget request. Also, continuing into FY2010, the program will make significant investments in mass data storage systems to replace systems that will reach the end of their life cycle. These efforts are planned to continue into future years with no set completion date.				
Networking The Defense Research and Engineering Network (DREN) provides wide area network (WAN) connectivity among the Department's S&T and T&E communities. *FY 2008 Accomplishments:* The DREN provided high speed wide area network services to over 130 locations throughout the United States. DREN continued collaborative work with the federal networking community and standards associations. As result of prior year funding reductions the number site specific security assessments declined with more fully automated and remote security tools providing some augmentation. *FY 2009 Plans:* Network services to link all elements of the program will be provided by the DREN as well as operation of security systems and enhancements. Collaborative work with the federal networking community and standards associations will continue to assure that the DREN will remain compatible with future technology change. These efforts are planned to continue into future years with no set completion date. *FY 2010 Plans:* Network services to link all elements of the program will be provided by the DREN as well as operation of security systems and enhancements. Collaborative work with the federal networking community	28.833	31.443	29.589	

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B. Accomplishments/Planned Program ($ in Millions)	**FY 2008**	**FY 2009**	**FY 2010**	**FY 2011**
and standards associations will continue to assure that the DREN will remain compatible with future technology change. These efforts are planned to continue into future years with no set completion date.				
Software Applications	62.137	80.479	82.506	

Software Applications provide for the adaptation of broadband, widely used applications and algorithms to address S&T and T&E requirements, continued training of users as new system designs and concepts evolve, and continuous interaction with the national HPC infrastructure, including academia, industry, and other government agencies to facilitate the sharing of knowledge, tools, and expertise.

FY 2008 Accomplishments:
Development efforts in software programs continued to mature as other projects were completed, and others begun. The HPCMP through the Computational Research and Engineering Acquisition Tools and Environments (CREATE) initiative expanded HPC to the development of supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department.   Software Engineering Institutes and portfolios developed shared scalable applications to exploit scalable HPC assets. An Academic Outreach Program was supported to encourage and support computational science in universities across the United States. The User Productivity Enhancement and Technology Transfer (PET) effort provided computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. Efforts were maintained to develop technologies and methodologies to protect and limit end-use of high performance computing applications software while minimizing the burden on authorized end-users.

FY 2009 Plans:
Computational Research and Engineering Acquisition Tools and Environments (CREATE) will continue development of supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department.   Development efforts in software programs will continue to mature as other projects are completed, and others begun with a greater emphasis on engineering applications. Software Engineering Institutes and portfolios will continue to develop shared scalable applications to exploit scalable HPC assets. An Academic Outreach Program will continue to be

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B. Accomplishments/Planned Program ($ in Millions)	FY 2008	FY 2009	FY 2010	FY 2011
supported to encourage and support computational science in universities across the United States. The Programming Environments and Training (PET) effort will provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. Existing contracts supporting the PET effort will be re-competed with a new award (s) made in FY2009. On-going efforts will be maintained to develop technologies and methodologies to protect and limit end-use of high performance computing applications software while minimizing the burden on authorized end-users. These efforts are planned to continue into future years with no set completion date. *FY 2010 Plans:* Computational Research and Engineering Acquisition Tools and Environments (CREATE) will continue development of supercomputer-based engineering design and test tools to improve the acquisition process for major weapons systems across the Department. Development efforts in software programs will continue to mature as other projects are completed, and others begun with a greater emphasis on engineering applications. Software Engineering Institutes and portfolios will continue to develop shared scalable applications to exploit scalable HPC assets. An Academic Outreach Program will continue to be supported to encourage and support computational science in universities across the United States. The Programming Environments and Training (PET) effort will provide computational and computer science support to the DoD HPC user community through interaction and collaborative projects with academic and industrial partners. On-going efforts will be maintained to develop technologies and methodologies to protect and limit end-use of high performance computing applications software while minimizing the burden on authorized end-users. These efforts are planned to continue into future years with no set completion date.				

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C. Other Program Funding Summary ($ in Millions)

	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	Cost To Complete	Total Cost
090219D8Z/Major Equipment OSD	50.784	52.410	53.105						Continuing	Continuing

D. Acquisition Strategy

Not applicable for this item.

E. Performance Metrics

Strategic Goals supported are as follows:

Defense Supercomputing Resource Centers - Method of Measurement: Habus (HPCMP standard measurement of computational performance)

FY2008: Existing Baseline – 522.4/ Planned Performance Improvement - Requirement Goal – 191.1/ Actual Performance Improvement – 453.0
FY2009: Existing Baseline – 975.4/ Planned Performance Improvement - Requirement Goal – 585.2
FY2010: Existing Baseline – 1560.6/ Planned Performance Improvement - Requirement Goal – 936.4

Networking - Method of Measurement: Gigabits per second

FY2008: Existing Baseline – 25.2/ Planned Performance Improvement - Requirement Goal – 1.0/ Requirement Goal/ Actual Performance Improvement – 5.4
FY2009: Existing Baseline – 30.6/ Planned Performance Improvement - Requirement Goal – 1.0
FY2010: Existing Baseline – 31.6/ Planned Performance Improvement - Requirement Goal – 1.0

Software Applications - Methods of Measurement: Customer Satisfaction on a 0-5 scale

FY2008: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2/ Actual Performance Improvement – 4.4
FY2009: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2
FY2010: Existing Baseline – 4.2/ Planned Performance Improvement - Requirement Goal – 4.2

Comment: All FY2008 actual performance metrics exceeded those planned.